PCAPP EDS RCRA Modification Date: October 2013 Revision No. 0

ATTACHMENT D-3 SUBPARTS BB AND CC COMPLIANCE STRATEGY

1

PCAPP EDS RCRA Modification

Date: October 2013 Revision No. 0

1

(This page intentionally left blank.)

Revision No. 0

1	ATTACHMENT D-3	
2	SUBPARTS BB AND CC COMPLIANCE STRATEGY	
3		
4	1.0 GENERAL	
5		
6	This Plan describes how Pueblo Chemical Agent-Destruction Pilot Plant (PCAPP) Explosive Des	struction
7	System (EDS) site operations will comply with the air emissions requirements of the Colorado (Code of
8	Regulations 6 CCR 1007-3 § 264.1030 through 264.1090 (Subparts AA, BB, and CC). The Sub-	part AA,
9	BB, and CC regulations control air emissions from certain process vents and equipment leaks, as	s well as
10	air emissions from certain tanks, containers, and surface impoundments. The purpose of the Res	source
11	Conservation and Recovery Act (RCRA) organic air emission standards is to control air emissio	ns from
12	hazardous waste treatment, storage, and disposal units as necessary to protect human health and	the
13	environment. Subpart AA requirements are not applicable because the EDS units and the Conta	iner
14	Storage Unit (CSU) do not contain any process vents associated with distillation, fractionation, t	hin film
15	evaporations, solvent extraction, or steam stripping.	
16		
17	2.0 PURPOSE	
18		
19	This document focuses on the applicability of Subparts BB and CC for the EDS units and Subparts	rt CC for
20	the CSU and the PCAPP EDS less than 90-day hazardous waste storage area. Subpart BB requi	rements
21	are not applicable to the CSU and less than 90-day hazardous waste storage area because these h	azardous
22	waste management units do not contain any equipment as defined in 6 CCR 1007-3 § 264.1031.	
23		
24	Compliance strategies in this plan apply to the reduction of organic air emissions from EDS equ	ipment
25	that contains or contacts hazardous waste of at least 10 percent organic content and to the manage	gement of
26	EDS containers, such as the Containment Vessel and Waste Transfer Subsystem waste container	rs, that
27	receive hazardous waste with an average volatile organic concentration at the point of origin of	greater
28	than or equal to 500 parts per million by weight (ppmw), and from containers that will be stored	in the
29	CSU and at the PCAPP EDS less than 90-day hazardous waste storage area.	
30		
31	Section 3 describes the applicability and specific compliance with Subpart BB regulations for El	DS
32	equipment leaks. Section 4 describes the applicability and specific compliance with Subpart CC	
33	regulations for the EDS units, CSU, and the PCAPP EDS site less than 90-day hazardous waste	storage
34	area containers. Each section provides information on compliance methods, inspection and mon	itoring,
35	and recordkeeping.	

Date: October 2013 Revision No. 0

1 Colorado adopted the provisions of 40 CFR 264 Subparts AA, BB, and CC in their entirety. Therefore,

federal citations are incorporated by reference throughout this document.

3

2

3.0 APPLICABILITY OF 6 CCR 1007-3 § 264 SUBPART BB – AIR EMISSIONS STANDARDS FOR EQUIPMENT LEAKS [6 CCR 1007-3 § 264.1050]

6 7

8

9

5

The Subpart BB requirements apply to equipment¹ that contains or contacts hazardous waste of at least 10 percent organic content by weight and is managed in hazardous waste management units that are either:

10 11

• Subject to the permitting requirements of 6 CCR 1007-3 § 100.10

12 13

• A recycling unit that is located at a hazardous waste management facility that is otherwise subject to permitting, or

141516

A less than 90-day accumulation unit exempt from permitting under 6 CCR 1007-3
 § 262.34(a) and that is not a recycling unit under § 261.6.

17 18

- Each EDS unit contains equipment as defined in 6 CCR 1007-3 § 264.1031, are subject to permitting, and
- will be used to manage hazardous wastes with an organic concentration of at least 10 percent by weight.
- 21 Therefore, Subpart BB requirements are applicable to the EDS equipment.

22

- 23 The 10 percent by weight organic determination is based on generator knowledge of the hazardous waste
- to be managed in the EDS units. This determination meets the requirements specified in 6 CCR 1007-3
- 25 § 264.1063(d)(3).

- 27 To comply with Subpart BB, affected equipment must be uniquely identified and a determination made as
- to whether the equipment is "in gas/vapor service," "in light liquid service," or "in heavy liquid service."
- 29 For the EDS units, all affected equipment is uniquely identified and a service class assigned. Therefore,
- 30 no waste analyses or sampling is planned for air emission waste determinations. All equipment
- 31 contacting any hazardous waste for greater than 300 hours per year is subject to regulation.

¹ "Equipment" means each valve, pump, compressor, pressure relief valve, sampling connection system, open-ended valve or line, flange, or other connector, and any control devices or systems required by Subpart AA [6 CCR 1007-3 § 264.1031].

1	The E	DS Subp	part BB equipment of concern is as follows:
2			
3		•	Valves located on the Containment Vessels and valves located in the Waste Transfer
4			Subsystems (valves on Intermediate Tank and process waste containers 1 and 2) for each
5			EDS unit
6			
7		•	Sample connection systems (in each EDS unit)
8			
9		•	Double diaphragm pan pumps located in each EDS trailer containment pan.
10			
11		•	Double diaphragm pumps located in the Waste Transfer Subsystem for each EDS unit.
12			
13	Table	Attachi	ment D-3-1 lists the EDS equipment items and method of compliance as required by
14	6 CCF	R 1007-3	§ 264.1064(b)(1), 264.1064(g)(1), 264.1064(g)(5), and 264.1064(h). The table also
15	includ	es locati	on, state (liquid or vapor), and percent by weight organics.
16			
17	3.1	Subpa	art BB Exemptions
18			
19	Subpa	rt BB re	gulations contain two exemptions:
20			
21		•	Exemption 1 [§ 264.1050(e)]. Equipment that is "in vacuum service" is exempt from
22			applicable standards if the equipment is identified according to § 264.1064(g)(5). "In
23			vacuum service" means that the equipment is operating at an internal pressure that is at
24			least 5 kilopascals (kPa) below ambient pressure. This exemption is not applicable
25			because the EDS units operate at pressures greater than 5 kPa below ambient pressure.
26			
27		•	Exemption 2 [§ 264.1050(f)]. Equipment that contains or contacts hazardous waste with
28			an organic concentration of at least 10 percent by weight for less than 300 hours per
29			calendar year is identified as required in § 264.1064(g)(6). Equipment items identified as
30			operating in contact with hazardous waste for less than 300 hours per calendar year are
31			identified in Table Attachment D-3-1 as part of this Plan and by this Plan are identified
32			and documented in the operating record in accordance with § 264.1064(g)(6).

Table Attachment D-3-1. EDS Phase 2 Unit Equipment Items

Essisses				Percent by	
Equipment ID ^a	Location	Equipment Type	Liquid or Vapor	Weight Organics	Compliance Method
19	Vapor Sample Line/Vessel Door	Valve	V	> 10%	Exempt, operates less than 300 hours per year [§ 264.1050(f)]
20	Vapor Sample Line	Sample Connection System	V	> 10%	Closed-Loop System [meets § 264.1055(c)]
24	Liquid Sample Line/Vessel Door	Valve	L	> 10%	Exempt, operates less than 300 hours per year [§ 264.1050(f)]
25	Liquid Sample Line/Vessel Door	Sample Connection System	L	> 10%	In situ sampling device, exempt [§ 264.1055(c)]
21	Vessel Door	Valve	L/V	> 10%	Monitor during operations
22	Vessel Door	Valve	L/V	> 10%	Monitor during operations
23	Vessel Door	Valve	L/V	> 10%	Monitor during operations
26	Vessel Door	Valve	L/V	> 10%	Monitor during operations
27	Waste Transfer Subsystem	Valve	L	> 10%	Exempt, operates less than 300 hours per year [§ 264.1050(f)]
31	Waste Transfer Subsystem	Valve	L	> 10%	Exempt, operates less than 300 hours per year [§ 264.1050(f)]
33	Waste Transfer Subsystem	Valve	L	> 10%	Exempt, operates less than 300 hours per year [§ 264.1050(f)]
34	Waste Transfer Subsystem	Valve	L	> 10%	Exempt, operates less than 300 hours per year [§ 264.1050(f)]
39	Waste Transfer Subsystem	Valve	L	> 10%	Exempt, operates less than 300 hours per year [§ 264.1050(f)]
40	Waste Transfer Subsystem	Valve	L	> 10%	Exempt, operates less than 300 hours per year [§ 264.1050(f)]
49	Waste Transfer Subsystem	Valve	L	> 10%	Exempt, operates less than 300 hours per year [§ 264.1050(f)]
63	Waste Transfer Subsystem	Valve	L	> 10%	Exempt, operates less than 300 hours per year [§ 264.1050(f)]
65	Waste Transfer Subsystem	Valve	L	> 10%	Exempt, operates less than 300 hours per year [§ 264.1050(f)]

Table Attachment D-3-1. EDS Phase 2 Unit Equipment Items (Continued)

Equipment ID ^a	Location	Equipment Type	Liquid or Vapor	Percent by Weight Organics	Compliance Method
67	Waste Transfer Subsystem	Valve	L	> 10%	Exempt, operates less than 300 hours per year [§ 264.1050(f)]
68	Waste Transfer Subsystem	Valve	L	> 10%	Exempt, operates less than 300 hours per year [§ 264.1050(f)]
Pan Pump P-305	Waste Transfer Subsystem	Pump	L	> 10%	Monitor during operations
Intermediate Tank Pump (TBD)	Waste Transfer Subsystem	Pump	L	> 10%	Monitor during operations
Pressure Relief (PR) 500A	Process Waste Container 1	Valve	V	> 10%	During normal operation, the device is in the closed sealed position. The regulations require that after a pressure release has occurred, the relief valve is to be returned to a condition of no detectable emissions as indicated by instrument reading of less than 500 parts per million (ppm) above background, as soon as practicable but no later than 5 calendar days after each pressure release, unless a delay in repair is necessary under § 264.1054(b)(1). Leak detection monitoring is to be conducted per § 264.1063(c) using Reference Method 21. However, for EDS operations, the rupture disc will be replaced if a pressure release occurs. Replacing the rupture disc is a more conservative measure than returning the disc to service; thus, the intent of the regulation is more than met and no leak detection monitoring is required.

Date: October 2013 Revision No. 0

Table Attachment D-3-1. EDS Phase 2 Unit Equipment Items (Continued)

Equipment ID ^a	Location	Equipment Type	Liquid or Vapor	Percent by Weight Organics	Compliance Method
Pressure Relief (PR) 500B	Process Waste Container 1A	Valve	V	> 10%	During normal operation, the device is in the closed sealed position. The regulations require that after a pressure release has occurred, the relief valve is to be returned to a condition of no detectable emissions as indicated by instrument reading of less than 500 parts per million (ppm) above background, as soon as practicable but no later than 5 calendar days after each pressure release, unless a delay in repair is necessary under § 264.1054(b)(1). Leak detection monitoring is to be conducted per § 264.1063(c) using Reference Method 21. However, for EDS operations, the rupture disc will be replaced if a pressure release occurs. Replacing the rupture disc is a more conservative measure than returning the disc to service; thus, the intent of the regulation is more than met and no leak detection monitoring is required.

Note:

^a Pumps, Sample Connection System Valves, and ID numbers are identified in **Figure Attachment D-3-1**.

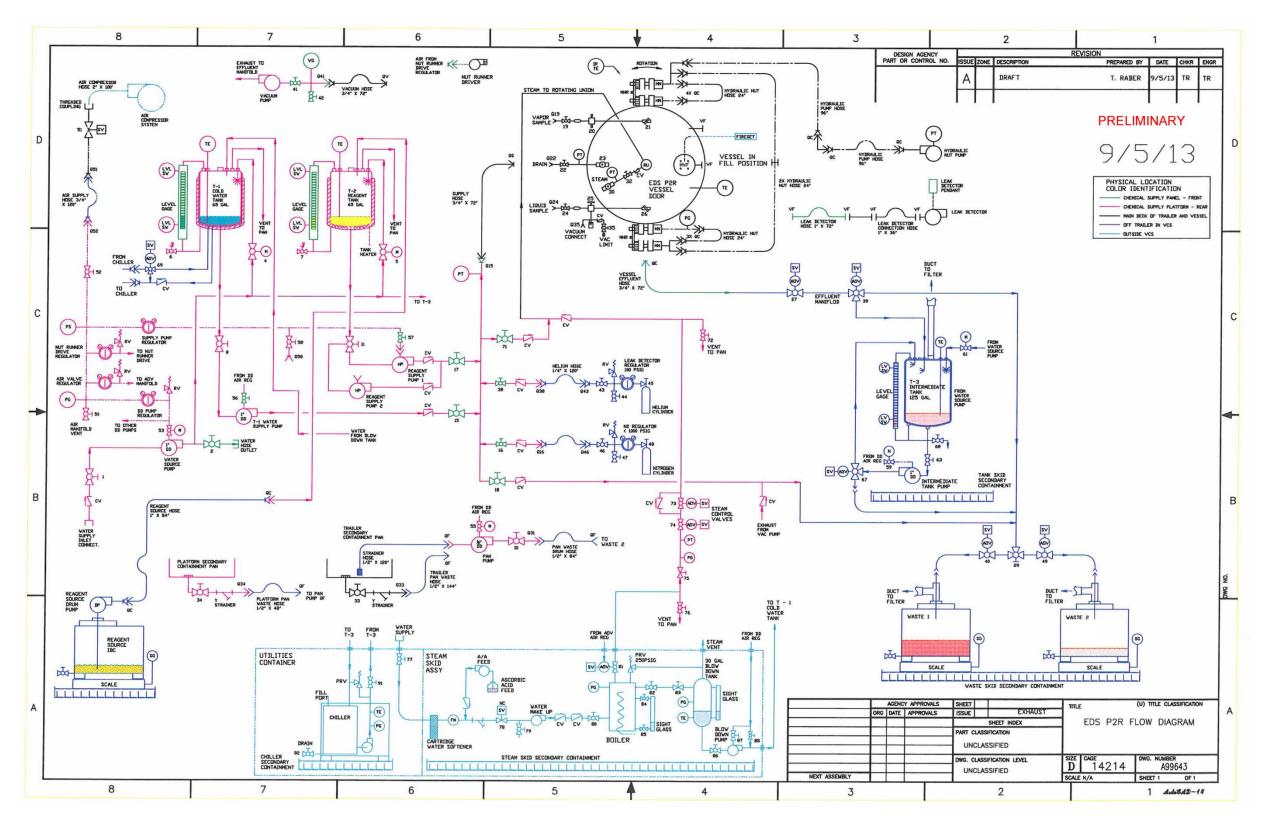


Figure Attachment D-3-1. EDS Phase 2 Unit Flow Diagram

Attachment D-3-7/D-3-8 PCAPPEDSR0.ATT D-3

Revision No. 0

- Additionally, associated with each equipment type, there are exemptions pertaining to monitoring and
- 2 inspection frequency requirements. These equipment-specific exemptions are summarized in **Table**
- 3 Attachment D-3-2 along with comments on applicability to EDS equipment items.

4 5

3.2 Overall Compliance Strategy

6 7

This attachment identifies the service type, equipment type, and compliance methodology for each piece of equipment. A process description of the EDS is provided in Section D of this permit modification.

9 10

8

3.3 Determination of Service Type

11

- There are three classes of service under § 264.1051: (1) "in gas/vapor service," (2) "in light liquid
- service," and (3) "in heavy liquid service." "In gas/vapor service" is defined as containing or contacting a
- waste stream that is in the gaseous state at operating conditions. "In light liquid service" is defined as
- 15 containing or contacting a stream where at least one organic component has a vapor pressure greater than
- 16 0.3 kPa at 20°C, the total concentration of the pure organic component(s) having vapor pressure greater
- than 0.3 kPa at 20°C is 20 percent by weight or greater, and the fluid is a liquid at room temperature. "In
- heavy liquid service" is defined as equipment not "in gas/vapor service" or "in light liquid service." It is
- 19 necessary to know the methods of operation to determine the type of service.

20

- 21 The EDS units can operate in two distinct modes. One mode treats liquid chemical agents with organic
- 22 liquid reagents. The other mode is to process phosgene or other gases in vapor form with caustic liquid
- 23 reagent. All organic liquid components and chemical agents have vapor pressures at 20°C of less than
- 24 0.3 kPa. The PCAPP EDS operations will only involve chemical agent mustard (distilled sulfur mustard
- 25 [HD]/mustard-T mixture [HT]), thus will operate in only the liquid treatment mode.

- 27 The vapor pressure for the treatment reagent monoethanolamine (MEA) is 0.0117 kPa.² The vapor
- pressure of mustard agent is 0.00896 kPa. Therefore, when treating liquid chemical agents with organic
- 29 reagents, the EDS treatment equipment will be "in heavy liquid service."

SAIC Calculation of Vapor Pressure from Gomez-Thodos Correlation data from Reid, Robert C., John M. Prausnitz, and Bruce P. Poling, *The Properties of Gases and Liquids*, 4th Edition, McGraw-Hill Book Co., 1987. (MEA)

Table Attachment D-3-2. Subpart BB Equipment Standards and Exemptions

Equipment Type/General Requirement	Exemption	Applicable/Comment
1. Sampling Connection Systems [§ 264.1055(c)]. Sampling connection systems must be equipped with a closed-purge, closed-loop, or closed-vent system. The system must collect the sample purge and return the sample purge to the process or route it to the appropriate treatment system. Gases displaced during filling of a sample container do not have to be collected or captured.	In-situ sampling systems are exempt per [§ 264.1055(c)].	Each EDS unit has two sample connection systems. A: The EDS Vapor Sample System is closed-loop and meets requirements. Purged wastes are returned to the process. Meets [§ 264.1055(c)]. B: The EDS Liquid Sampling System is <i>in-situ</i> and is exempt per [§ 264.1055(c)].
2. Valves in Gas/Vapor Service or in Light Liquid Service [§ 264.1057(a)]]. Monitor monthly to detect leaks	Valves designated as no detectable emissions as indicated by instrument reading of less than 500 ppm above background	Not applicable to PCAPP EDS site operations.
using methods specified in [§ 264.1063(b)] (Method 21).	2. Valve designated as unsafe to monitor, provided determination is made that required monitoring would pose immediate danger to monitoring personnel, and owner/operator follows written plan to monitor valve as frequently as practicable during safe-to-monitor times.	2. Not applicable to PCAPP EDS site operations.
	3. Valve is designated as difficult to monitor, and therefore, exempt if the valve cannot be monitored without elevating monitoring personnel 2 meters above a support surface; the hazardous waste management unit in which the valve is located was in operation before June 21, 1990; or the owner or operator of the valve follows a written plan to monitor the valve at least once per calendar year.	3. Not applicable to PCAPP EDS site operations.

Revision No. 0

Table Attachment D-3-2. Subpart BB Equipment Standards and Exemptions (Continued)

Equipment Type/General Requirement	Exemption	Applicable/Comment
3. Pumps and Valves in Heavy Liquid Service, Pressure Relief Devices in Light Liquid Service or Heavy Liquid Service, and Flanges and Other Connectors [§ 264.1058(a)]. Must be monitored within 5 days if evidence of potential leak is observed.	There are no exemptions.	There are no exemptions.

Notes:

EDS

1 2 3 4 5 6 Explosive Destruction System Pueblo Chemical Agent-Destruction Pilot Plant PCAPP

ppm parts per million PCAPP EDS RCRA Modification

Date: October 2013 Revision No. 0

3.4 Monitoring of Equipment

1	
2	

- 3 During EDS operations, near real-time monitoring will be performed using MINICAMS[®]. MINICAMS
- 4 alarms will be confirmed using Depot Area Air Monitoring System (DAAMS). Historical monitoring
- 5 will be performed using DAAMS tubes for chemical agent. No historical monitoring is required for
- 6 industrial chemicals.

7

- 8 Periodically, a helium leak test will be conducted to confirm the integrity of the Containment Vessel door
- 9 seals using the helium leak detector. During routine maintenance (per the EDS operations and
- maintenance schedule), the vessel door metal seal and high-voltage flange seal, vessel door feedthroughs,
- medium pressure valves and fittings are leak checked.

12

- 13 Attachment F-2 of this permit modification identifies the maximum concentration value for mustard
- agent not to be exceeded for a given period of time, depending on the level of protection worn by
- personnel. The monitoring levels are below the 10,000 parts per million (ppm) designation for a leaking
- piece of equipment required in in 6 CCR 1007-3 § 264.1057(b), 264.1058(b), and 264.1061(c)(2).
- 17 **Attachment F-2** of this permit modification contains information on the monitoring devices.

18

- 19 The intention of the RCRA Subpart BB regulations is to reduce organic vapor emissions from specific
- 20 types of equipment. Workspace monitoring conducted during EDS operations, coupled with periodic leak
- 21 tests of the Containment Vessel door, is a more conservative approach than the monthly monitoring
- required by the regulations and will identify any equipment leaks.

2324

3.5 Repair and Leak Testing

- In the event of a monitoring alarm, the munition or item will be secured and the source of the alarm will
- be investigated. Leaking equipment will be replaced as soon as operationally feasible but no later than
- prior to processing the next munition. Regulations 6 CCR 1007-3 § 264.1057(d) and 264.1058, require
- 29 that the first repair attempt be within 5 days of when a potential leak is identified. For the PCAPP EDS
- 30 site operation, all suspected leaks will be verified and repaired as necessary within 5 calendar days.
- 31 Post-repair leak testing will be conducted on the affected area of the system. Post-repair leak testing is
- 32 defined as testing after a detected leak is repaired. After routine preventive maintenance, the EDS units
- will be returned to service and monitored in accordance with monitoring criteria in this attachment.
- 34 Equipment testing after completing routine preventive maintenance is not required for compliance with
- 35 this Plan.

Revision No. 0

1	
2	

3.6

3 The EDS AFS carbon filters are an added protection feature and not subject to Subpart BB. A description

4 of the AFS is provided in **Attachment D-1** and performance calculations are provided in

EDS Air Filtration System (AFS) Carbon Filter System

5 **Attachment D-4** of the PCAPP EDS RCRA permit modification.

6 7

3.7 Recordkeeping and Reporting

8

- 9 Leak detection and worker safety monitoring results will be recorded in the PCAPP EDS site operating
- record and logged in accordance with § 264.1064(d). Operating hours³ per year will be recorded for
- equipment items identified as exempt (see **Table Attachment D-3-1**) under § 264.1050(d), per
- requirements in § 264.1064, using a form presented in **Figure Attachment A-1**. All required reports will
- be submitted in accordance with § 264.1050. A schematic is provided in lieu of individually marking the
- equipment item required by § 264.1050(d). See **Figure Attachment D-3-1** for equipment location
- 15 schematic.

16 17

4.0 APPLICABILITY OF 6 CCR 1007-3 § SUBPART CC – AIR EMISSION STANDARDS

FOR TANKS, CONTAINERS, AND SURFACE IMPOUNDMENTS [6 CCR 1007-3

19 § 264.1080]

20

- 21 Subpart CC requirements apply to permitted treatment, storage, and disposal facilities (TSDFs) that
- 22 manage hazardous waste in tanks, containers, surface impoundments, or miscellaneous units and to large
- 23 quantity generators that accumulate hazardous wastes in tanks and containers. Waste management units
- that contain hazardous wastes with an average volatile organic concentration of greater than or equal to
- 25 500 ppmw at the point of origin are subject to Subpart CC requirements. This section describes the
- applicability of Subpart CC to the EDS unit and the less than 90-day hazardous waste storage area,
- including exclusions and exemptions, as well as the requirements specified by 6 CCR 1007-3 § 264.1080.

- 29 The PCAPP EDS site will contain RCRA-permitted EDS units and the CSU, plus a less than 90-day
- 30 hazardous waste storage area. The less than 90-day hazardous waste storage area will be located at
- 31 Pueblo Chemical Depot (PCD), a large quantity generator; therefore, the Subpart CC requirements apply.

Operating hours are defined as direct contact time with hazardous wastes as measured from the time draining of wastes from EDS Containment Vessel starts until the time draining ends.

PCAPP EDS RCRA Modification

Date: October 2013 Revision No. 0

1	A waste determination (through chemical analysis or process knowledge) is required to prove a waste
2	stream is exempted from Subpart CC. No determination is required if the wastes are placed in waste

- 3 management units that employ air emission controls in compliance with Subpart CC. For ease of
- 4 operation, the Army assumes that the EDS units, CSU, and less than 90-day hazardous waste storage area
- 5 will contain hazardous waste with an average volatile organic concentration of greater than or equal to
- 6 500 ppmw at the point of waste origin. This means that all wastes entering and exiting the EDS units and
- 7 entering the CSU and less than 90-day hazardous waste storage area for storage will be subject to the
- 8 Subpart CC requirements unless a particular waste stream or waste management unit meets an exclusion
- 9 or exemption and that exclusion or exemption is documented in this Plan.

10 11

4.1 Levels of Control for Containers

12

- 13 For containers, there are three levels of controls. Container controls are based on design capacity, total
- organic content of the material in the container (in or out of light service), and use of the container (for
- example, treatment by stabilization or other methods).

16 17

4.2 Levels of Control for Tanks

18 19

- For tanks, there are two levels of controls. Tank controls are based on design capacity, maximum organic
- vapor pressure of the material in the tank, and use of the tank (for example, treatment by stabilization).

2122

4.3 Method of Compliance or Exemptions

23

- 24 The total organic content of the material in the container refers to whether the material is "in" or "out" of
- 25 light service. In or out of light service is determined by the vapor pressure of the waste material at 20°C.
- 26 This determination is required when storing wastes in containers that are greater than 0.46 m³
- 27 (121 gallons). For this EDS operation, waste containers greater than 0.46 m³ (121 gallons) by volume are
- 28 considered in heavy service based on the vapor pressures of mustard agent and the MEA treatment
- reagent described in Section 3.3.

30

31

CSU

- 33 The CSU will be used to store energetic munitions, Department of Transportation (DOT) cylinders, and
- other miscellaneous items that contain chemical agent mustard, pending treatment in an EDS. The

- munitions and miscellaneous items to be stored will be contained in overpacks.⁴ The overpacks are the
- 2 primary containers. All of the overpacks and DOT cylinders that will be stored at the CSU are less than
- or equal to 0.1 m³ (26 gallons) and are, therefore, exempt from the Subpart CC regulations per
- 4 6 CCR 1007-3 § 264.1080(b)(2). If a larger overpack container were used for storage, that is, a container
- 5 greater than 26 gallons in volume, the container will meet Level 1 controls required for containers that are
- 6 greater than 0.1 m³ (26 gallons) and less than or equal to 0.46 m³ (121 gallons) by volume. Containers
- 7 greater than 0.46 m³ (121 gallons) will not be stored in the CSU.

8

EDS Units

10 11

- The EDS units comply with Subpart CC by meeting Level 1 controls for containers. In this aspect, the
- 12 Containment Vessel resembles a container greater than 0.46 m³ (121 gallons) in size, is not in light
- material service, and is equipped with a cover and closure device that forms a continuous barrier over the
- 14 container opening so that there are no visible holes, gaps, or other open spaces into the interior of the
- container when the cover and closure devices are secured [§ 264.1086(c)].

16 17

EDS Waste Transfer Subsystem

18 19

- The Waste Transfer Subsystem waste containers that have a design capacity greater than 0.1 m³
- 20 (26 gallons) and less than or equal to 0.46 m³ (121 gallons) meet Control Level 1 as they will comply
- 21 with one of the following requirements:

2223

• Container meets applicable DOT regulations on packaging hazardous materials for transportation under 49 CFR 107, 172, 173, 178, 179, and 180 [§ 264.1086(c)(1)]

242526

- Container is equipped with a cover and closure devices that form a continuous barrier over the container openings so that there are no visible holes, gaps, or other open spaces
- leading into the container when the cover and closure devices are secured.

⁴ DOT cylinders may or may not be contained in overpacks.

PCAPP EDS RCRA Modification

Date: October 2013 Revision No. 0

The Waste Transfer Subsystem waste containers that have a design capacity greater than 0.46 m³ 1 2 (121 gallons) will meet Control Level 3 by one of the following requirements: 3 4 Container meets applicable DOT regulations on packaging hazardous materials for transportation under 49 CFR 107, 172, 173, 178, 179, and 180 [§ 264.1086(c)(1)] 5 6 7 Container is vented directly through a closed-vent system to a control device. 8 The Waste Transfer Subsystem tank has a design capacity of less than 75 m³ and maximum organic vapor 9 pressure less than 76.6 kPa and complies with Tank Level 1 controls by meeting the following 10 11 requirements: 12 The calculated maximum organic vapor pressure of the waste in Intermediate Tank (T-4) 13 14 is 1.17 kPa, which is less than 76.6 kPa. The calculation is provided in **Attachment B** of this section. 15 16 The tank is equipped with a fixed roof and is connected by a closed-vent system that is 17 18 vented to a control device. 19 20 The tank is constructed of stainless steel, which is compatible with the waste that is 21 stored. 22 PCAPP EDS CSU and Less than 90-Day Hazardous Waste Storage Area 23 24 Containers less than or equal to 0.1 m³ (26 gallons) and larger will be used to store wastes (not in light 25 material service) at the PCAPP EDS CSU and less than 90-day hazardous waste storage area. All 26 27 containers, including those greater than 0.46 m³ (121 gallons), will meet Level 1 controls by meeting one 28 of the following requirements: 29 30 Container meets applicable DOT regulations on packaging hazardous materials for 31 transportation under 49 CFR 107, 172, 173, 178, 179, and 180 [§ 264.1086(c)(1)].

1	•	Container is equipped with a cover and closure devices that form a continuous barrier
2		over the container openings so that there are no visible holes, gaps, or other open spaces
3		leading into the container when the cover and closure devices are secured.
4		
5	4.4	Operating Requirements for Container Control Level 1
6		
7	Containe	ers will be kept closed except when adding, removing, or sampling wastes.
8		
9	4.5	Inspection, Recordkeeping, and Repair Requirements for Container Level 1
10		
11	Ensure c	losure devices (lids, bungs, covers) are in good condition (closed securely, no visible damage that
12	would in	npair storage). Containers using Control Level 1 must be visually inspected for defects at the
13	time the	waste is first managed in the container or when accepted at the facility (in this case, the CSU and
14	less than	90-day hazardous waste storage area). A visual inspection will be recorded when the containers
15	are conn	ected to the EDS Waste Transfer Subsystem to ensure good condition prior to processing wastes
16	in an ED	S; and also when waste containers are placed in the less than 90-day hazardous waste storage
17	area. Up	on discovering any defect, an effort will be made to repair the container within 24 hours. The
18	containe	r defect must be repaired or the container removed from service immediately if leaking.
19		
20	4.6	Operating Requirements for Tank Level 1 Controls
21		
22	The fixed	d roof openings will be closed and secured when hazardous waste is in the tank, except during
23	routine i	nspection, maintenance, sampling, sludge removal, or repair or replacement of internal tank
24	equipme	nt. Waste will be transferred into and out of the tank using a closed piping system.
25		
26	4.7	Inspection, Recordkeeping, and Repair Requirements for Tank Level 1 Controls
27		
28	The fixed	d roof and closure devices will be visually inspected for gaps, damaged seals and gaskets, and
29	broken o	r missing closure devices, initially and annually thereafter. Repairs will be initiated within

5 days of detection and completed no later than 45 days after detection.

PCAPP EDS RCRA Modification Date: October 2013 Revision No. 0

(This page intentionally left blank.)

1 ATTACHMENT A 2 OPERATING LOG FOR EDS EXEMPT EQUIPMENT ITEMS

PCAPP EDS RCRA Modification Date: October 2013 Revision No. 0

(This page intentionally left blank.)

6

		If Accum	nulated Time	Reaches 250	hours, conta	ct the Comma	nd Post or E	nvironmental (Coordinator			
DS Unit:					•							
					EQUIF	PMENT ID1						
DATE	TIME (24hr)	Valve 19 Vapor Sample Line	Valve 24 Liquid Sample Line	Valve 20 Vapor Sample Line	Valve 25 Liquid Sample Line	Valve 27 Motor- Driven Shut-Down	Valve 21 Vapor Sample Line	Valve 31 Pan Pump to Drum W3	Valve 33 Trailer Sump Y-Strainer	Valve 34 RSS Sump Y-Strainer	P-305 Pan Pump	(TBD) Intermediat Tank Pum
	Start:											
	Stop:											
	Start:											
	Stop:											
	Start:											
	Stop: Start:											
	Stop: Start:											-
	Stop:											
	Start:											
	Stop:											
	Start:											
	Stop:											
	Start:											
	Stop:											

[&]quot;Equipment ID" means each valve, pump, compressor, pressure relief valve, sampling connection system open-ended valve or line, flange, or other connector, and any control devices or systems that contains or contacts hazardous wastes with organic concentrations of at least 10 percent organic content by weight and is managed in a hazardous waste management unit.

Note: Times entered in columns divided by dotted lines are normally the same (i.e., waste flow between valves 37, 27, and 29).

Date: October 2013 Revision No. 0

			SUBPART	BB HAZARI	DOUS WAST	E TRANSFEI	R TIME TRAC	KING SHEE	Т			
		If Accum	nulated Time	Reaches 250	hours, contac	ct the Comma	and Post or Er	nvironmental	Coordinator			
Unit:												
						MENT ID ¹						
DATE	TIME (24hr)	Valve 22 Vapor Effluent Hose	Valve 23 Vapor Effluent Hose	Valve 26 Liquid Sample Line	Valve 39 Vessel Effluent Hose	Valve 40 Vessel Effluent Hose	Valve 49 Vessel Effluent Hose	Valve 63 Tank Effluent Hose	Valve 65 Tank Effluent Sample Line	Valve 67 Tank Effluent Hose	Valve 68 Tank Effluent Sample Line	
	Start:											
	Stop:											
	Start:											
	Stop:											
	Start:											<u> </u>
	Stop:											
	Start:											
	Stop:											
	Start:											
	Stop:											
	Start:											
	Stop:											
	Start:											-
	Stop:											
	Start:											
	Stop:											
ımulated Transfer												
mm)	i iiiie.											

Note: Times entered in columns divided by dotted lines are normally the same (i.e., waste flow between valves 37, 27, and 29).

Figure Attachment A-1. Example Subpart BB Hazardous Waste Transfer Time Tracking Sheet (Sheet 2 of 2)

[&]quot;Equipment ID" means each valve, pump, compressor, pressure relief valve, sampling connection system open-ended valve or line, flange, or other connector, and any control devices or systems that contains or contacts hazardous wastes with organic concentrations of at least 10 percent organic content by weight and is managed in a hazardous waste management unit.

PCAPP EDS RCRA Modification Date: October 2013 Revision No. 0

1	ATTACHMENT B
2	CALCULATION OF MAXIMUM ORGANIC VAPOR PRESSURE OF HAZARDOUS WASTE
3	IN INTERMEDIATE TANK T-4

PCAPP EDS RCRA Modification Date: October 2013 Revision No. 0

(This page intentionally left blank.)

EDS-ITVP CALC - 1

CALCULATION COVER SHEET

Calculation Number: EDS-ITVP CALC - 1 Revision Number: 0 Page 1 of 15 Title: Calculation of Maximum Organic Vapor Pressure in the Intermediate Tank Headspace Project Identification Number: Key Words: HD, EDS, Intermediate Tank, Headspace, Vapor Pressure Charge Number: Purpose: The purpose of this calculation is to determine the maximum organic vapor pressure of the neutralent in the Intermediate Tank headspace, and to demonstrate compliance with the regulatory requirement. Summary of Results: As shown in Table 2 (highlighted row), the maximum organic vapor pressure of the Intermediate Tank headspace will be 0.169 psi, or 1.17 kPa. This value is less than the regulatory limit of 76.6 kPa. Name (print or type): Signature: Date: Originator(s): Richard Travis Reviewed by: Sanjay Saraiya DM/Responsible Manager: C. Murk Van Basten

PCAPP EDS RCRA Modification

Date: October 2013 Revision No. 0

EDS-ITVP CALC - 1

CALCULATION REVISION LOG

Calculation Number: EDS-ITVP CALC - 1

Revision Number: 0

Page 2 of 15

Revision	Affected <u>Pages</u>	Reason for Revision	Description of Revision:
0	All	Original Issue	

EDS-ITVP CALC - 1

CALCULATION TABLE OF CONTENTS

			Calculation I Revision Nu Page 3 of 18	mber: (: EDS-ITVP CALC – 1
1.0 2.0 3.0 4.0 5.0 6.0	Regulatory Requiremer Assumptions Methodology Results and Conclusion	nt			
Com	puter Programs Used				
Name	e	Version #	Configu Cont Versi	trol	If NO, Description on Page/in Reference
Micro	soft Office Excel 2010		YES	NO	
			_ YES	NO	
			YES	NO	
			_ YES	NO	
			YES	NO	

Date: October 2013 Revision No. 0

EDS-ITVP CALC - 1

CALCULATION CHECKLIST

Reviewers: Sanjay Saraiya	Signature:	llania.	Date:	0/1	2
Satijay Satalya		port	8//	7//	<u> </u>
 Is the subject and/or purpose. Are the required input da Are the assumptions clear with the calculation purpose. Are the analytical method Are the design inputs util Are the versions of the co Are sample input listings 	ta and their referency and identified, validose? so clearly identified ized appropriately omputer programs for all computer programs.	ences provided? d, and consistent d? /? s used identified?		NO NO NO NO NO NO	NA NA NA
documented in the calcul 8. Are the results and concl 9. Are the results consisten	usions clearly sta		(YES) (YES)	NO NO	
If NO to any of the above, pr	ovide sheet num	ber(s) with justificat	ion:		
REVIEWER'S COMMENTS	AND REVIEW M	ETHOD USED (Ch	eck all that	apply):
				•	
Used alternative method calculation Compared results to othe calculations Spot-checked calculation Reviewed spreadsheet for Examined inputs and followethod through all steps	r similar c s [] srmulas	nethods ☐ Considered assu alculation purpose ☐ Recalculated all o ☐ Evaluated results	mptions in calculations against existence against existence and s	light o	f tions
Continued on additional sheet Number of additional sheets		mments	YE	s (NO

EDS-ITVP CALC - 1

CALCULATION SHEET

Calculation Number: EDS-ITVP CALC – 1 Revision Number: 0

Page 5 of 15

1.0 Introduction

The Explosive Destruction System (EDS) Phase 2 Refit (P2R) will be configured with an Intermediate Tank which will receive the hot neutralent from the EDS Containment Vessel. The purpose of the Intermediate Tank is to allow the neutralent to cool from 95°C to a temperature where it is safe to drain it into the waste drums.

2.0 Regulatory Requirement

Federal regulation 40 CFR 264.1084(b)(1) requires that, for a tank with a design capacity less than 75 cubic meters (approximately 19,813 gallons), that manages hazardous waste under RCRA Subpart CC Tank Level 1 controls for air pollutant emissions, the maximum organic vapor pressure limit is 76.6 kPa.

3.0 Assumptions

Scenario inputs are listed in Table 1 (at the end of the text). Key inputs and assumptions are described below.

- 1. Volumes and capacities based on EDS P2R.
- 2. The volume of neutralent entering the Intermediate Tank is equal to the volume of agent plus the volume of reagent plus any water added for cooling or flushing purposes. For this calculation a value of nuetralent is 290 L.
 - a. The maximum batch size to be treated in the EDS is a six-pack of 4.2-inch mortars. Assuming each mortar is 100 percent full, the amount of agent treated is 6.5 pounds (lbs) of HD per mortar for a total of 39 lbs which is approximately 13.9 liters (L) of HD (1L of HD weights 2.81 lbs).
 - b. The recipe calls for 10 parts reagent per part agent by liquid volume therefore the amount of reagent used is 139 L.
 - c. Amount of steam used is 276 lbs (125.5 L). This value will vary from batch to batch depending on how much steam is needed to achieve the desired temperature inside the EDS Containment Vessel. During 6-pack testing, the average was approximately 276 lbs with a range of ±6 lbs.
 - d. Amount of cooling water used. This number varies from batch to batch depending on how quickly the neutralient cools to a temperature where it can be drained to the Intermediate Tank. During testing the range was 0.0 lbs to 50 lbs. A value of 0.0 lbs was assumed for the calculation as it results in a slightly higher proportion of organic vapors in the Intermediate Tank headspace.

PCAPP EDS RCRA Modification

Date: October 2013 Revision No. 0

EDS-ITVP CALC - 1

- e. After draining the reagent it is assumed that up to 11 L of water are used to flush the plumbing.
- 3. The EDS Standing Operating Procedure specifies that the temperature of the neutralent shall be 95°C or less at the time it is drained to the Intermediate Tank. Therefore, for this calculation, the temperature of the Intermediate Tank headspace is assumed to be 95°C.
- 4. Capacity of the Intermediate Tank = 125 gallons (473 L)
- 5. Analytical results for HD neutralent analyses were used to identify organic constituents used in the calculations.
- 6. Atmospheric pressure was assumed to be 1 atmosphere (atm) at sea level or 14.7 pounds per square inch (psi)
- 7. Gases from the Intermediate Tank pass to the exhaust filtration system by a combination of displacement (as liquid is added to the tank) and by the fact that the exhaust filtration system operates at a slightly negative pressure. There are no valves to restrict gas flow from the Intermediate Tank headspace. Therefore, the vapor pressure of the Intermediate Tank headspace for this calculation is assumed to be 1 atm.

4.0 METHODOLOGY

EDS process inputs and scenario specific assumptions were used in conjunction with vapor pressures to calculate partial pressures of the organic constituents of the neutralent.

The constituents of the mustard agent neutralent have been determined by waste characterization analyses. Table 2 lists the organic constituents that have been identified along with pertinent physical properties. The concentration of each constituent was based on the average concentration found in previous waste analytical results. The average concentration rather than the maximum concentration can be used because the procedure specified in the regulation [40 CFR 264.1084(c)(3)] for sampling states that "a sufficient number of samples shall be collected to be representative of the waste contained in the tank.", which approximates the average concentration over time. Inorganic constituents of the neutralent along with metals and the inert gas used in the EDS were included in the calculation.

In Table 2, approximately 6 percent of the mass of the neutralent is labeled as "unknown compounds." This value was determined by summing the mass of the known constituents and subtracting that from the total mass of neutralent. In part the difference is due to the fact that average concentration values were used for the named constituents. Therefore, the sum of constituents will not necessarily add up to 1. Furthermore, the calculation assumes each of the mortars is 100 percent full of mustard agent. Historical studies of munitions filling operations indicate that munitions were closer to 85 percent full rather than 100 percent full. However, as the assumption of 100 percent fill will yield slightly larger values, the assumption was made that the mortars were 100 percent full. Finally, there are undoubtedly compounds present in the neutralent that on any given analysis come out as unknown or as tentatively identified

EDS-ITVP CALC - 1

compounds. For the calculation, a molecular weight and vapor pressure equal to the median values for the identified organic compounds less monoethanolamine (MEA) was used to represent the unknown fraction of the neutralent.

The following explanation uses acetone as an example.

a) The first step in the calculation was to determine the mass of each constituent in the neutralent. Mass of component is equal to the volume of neutralent times the concentration of the component in the neutralent.

Mass of acetone = concentration (0.25 mg/L) x volume of neutralent (290 L) = 71.6 mg

b) Next the number of moles of each component was calculated by dividing the grams of component by the molecular weight of the component.

Moles of acetone = mass of acetone (71.6 mg) / molecular weight of acetone (58.1) x (1/1000 gm/mg) = 1.23E-03 gm moles

c) The mole fraction of each component was determined by dividing the moles of component by the total number of moles of all components (organic and inorganic) in the neutralent.

Mole fraction = moles of acetone (1.23E-03) / total of all components (1.02E+04) = 1.21E-07

d) Finally partial pressure of each component was calculated by multiplying the vapor pressure of the component at 90°C by the mole fraction of the component.

Partial pressure = mole fraction of acetone (1.21E-07) x vapor pressure (7.60E+02 psia) = 1.77E-06 psia

e) The total organic vapor pressure of the Intermediate Tank headspace was determined by summing the partial pressures of each organic constituent.

5.0 RESULTS AND CONCLUSION

As shown in Table 2 (highlighted row), the maximum organic vapor pressure of the Intermediate Tank headspace will be 0.169 psi, or 1.17 kPa. This value is less than the regulatory limit of (76.6 kPa), as referenced in section 2.

PCAPP EDS RCRA Modification

Date: October 2013 Revision No. 0

EDS-ITVP CALC - 1

6.0 References (Sources of Antoine Equations)

USEPA AP-42 Table 7.1-5.

Peterson, G.W. and C.J. Karwacki, Filtration Performance Correlations of Military Filters Containing ASZN-TEDA Carbon, ECBC –TR-546, 2007.

National Institute of Standards and Technology (NIST), Material Measurement Laboratory, Chemistry WebBook, http://webbook.nist.gov/

Table 1. Scenario Inputs

	P2P Stea	m EDS So	cenario #3 (4. HD)	2-in 6-Pack
Agent to be Processed	HD			
Density of Agent	1.27	g/mi		
Munition to be Processed	4.2-in	ļ		
Number of Munitions in a Batch	6			
Amount of agent per munition	6.5	lbs		
Type of explosive in a munition and Amount in a Munition:				
Trinitrotoluene (TNT) NEW conversion 1:1	0	lbs		
RDX NEW conversion 1:1.2	0	lbs		
PETN NEW conversion 1:1.33	0	lbs		
Tetryl NEW conversion 1:1.21	0.140	lbs		
Tetrytol NEW conversion 1:1.15	0	lbs		
Comp B NEW conversion 1:1.13	0	lbs		
Black Powder NEW conversion 1:0.6	0	lbs		<u> </u>
Type of donor charge	Comp. B	***************************************		
Amount of donor charge in a batch (NEW factor 1.13)	1.630	lbs		
Maximum NEW allowed in P2 EDS	9	lbs		
Composition of Reagent (Weight Basis):				
Water	10	%		
MEA	90	%		
Propylene Glycol	0	%		
Ethanol	0	%		
NaOH	0	%		
NaMnO4	0	%		
Density of Reagent	1.02	g/ml		
Amount of reagent to be used in a batch	133	L for	30	lbs agent
	178	L for	50	lbs agent
Number of Neutralent Drains	1			
Fraction of Neutralent Volume left in EDS after Draining	0			
Maximum Fraction for Waste Container Filling	0.63			
Amount of Rinsate Used in first rinse	133	L	per rinse	
Amount of Rinsate Used in second rinse	133	L	per rinse	
Number of Rinses	2			
Temperature in EDS During Neutralization	100	°C		
Temperature in EDS During Neutralent Draining	95	°C		
Temperature in EDS during Rinsing Operation	100	°C		
Temperature During Draining of Rinsate	60	°C		
Ambient Pressure at site	14.7	psia		
Cycle Time for a Batch	30	min		

Date: October 2013 Revision No. 0

EDS-ITVP CALC - 1

Table 1. Scenario Inputs (Continued)

	P2P Stea	ım EDS Sc	cenario #3 (4.2-in 6-Pack HD)
Number of Batches Processed per day	1		
Number of Days Plant Operated per week	6		
Number of Weeks of Plant Operation per Year for Emission calculations	2		
Inert Purge Gas Component Fraction:			
Helium	No		
Nitrogen	Yes		
Initial pressure in Inert Purge Gas Tank	1200	psig	
Final Pressure in Inert Purge Gas Tank	700	psig	
Initial Volume of Inert Purge Gas in Tank	200	scf	
P2 EDS Vessel Volume	160	gal	
Neutralent Waste Container Volume	125	gal	
Rinsate Waste Container Volume	55	gal	
Surge Drum Volume	55	gal	
CFU Air Flow rate	4800	cfm	
CFU Gas Temperature	30	°C	
Moisture in CFU Air	2	% vol.	
Dry Standard Flow of CFU Air	4238	dscfm	
CFU Inlet Diameter	20	inch	
Internal Stack Diameter	18	inch	
Steam added to Neutralent during Heating	276	lbs	
Steam added to Rinsate during Heating	0	lbs	
Water added to neutralent for cooling to 90 C	0	lbs	
Presence of Carbon Filter on Neutralent Waste Container	Yes		
Number of EDSs on site	1		

Notes:

cfm = cubic feet per minute °C = degree centigrade

dscfm = dry standard cubic foot per minute

gal = gallon

g/mL = gram per milliliter

L = liter
lbs = pounds
min = minute

NEW = net explosive weight

psia = pound per square inch actual psig = pound per square inch gauge

scf = standard cubic feet %vol. = percent by volume

Table 2. Summary of Partial Pressure Calculation

		1		1	T	T]
Compounds Potentially Present in Intermediate Tank Headspace	Conc. in Neutralent (mg/L)	Mol. Wt	bp °C	VP at 95°C (mmHg)	VP at 95°C (psia)	Mass in Neutralent (mg)	Mass in Neutralent (gm moles)	Mole Fractions in Neutralent	Partial Pressure (psia)
As	0.28	74.9	130	2.52E+02	4.88E+00	8.11E+01	1.08E-03	1.06E-07	5.17E-07
Ва	0.76	137.3	1560	0.00E+00	0.00E+00	2.20E+02	1.60E-03	1.57E-07	0.00E+00
Cd	1.82	112.4	960	1.24E-07	2.40E-09	5.27E+02	4.69E-03	4.59E-07	1.10E-15
Cr	0.18	52.0	947	0.00E+00	0.00E+00	5.10E+01	9.81E-04	9.59E-08	0.00E+00
Pb	0.21	207.2	950	6.63E-12	1.28E-13	6.14E+01	2.96E-04	2.90E-08	3.72E-21
Se	0.75	79.0	196	0.00E+00	0.00E+00	2.16E+02	2.74E-03	2.68E-07	0.00E+00
Ag	0.12	107.9	1818	7.10E-19	1.37E-20	3.56E+01	3.30E-04	3.23E-08	4.44E-28
Hg	0.00	200.6	302	6.60E-02	1.28E-03	6.49E-01	3.24E-06	3.17E-10	4.04E-13
Mg	0.00	24.3	1412	1.23E-24	2.39E-26	0.00E+00	0.00E+00	0.00E+00	0.00E+00
К	24.30	39.1	1411	3.85E-17	7.45E-19	7.04E+03	1.80E-01	1.76E-05	1.31E-23
Na	33.00	23.0	1473	5.49E-18	1.06E-19	9.56E+03	4.16E-01	4.07E-05	4.32E-24
Zn	3.22	65.4	732	2.11E-10	4.07E-12	9.33E+02	1.43E-02	1.40E-06	5.68E-18
Ca	113.00	40.1	1600	1.05E-18	2.03E-20	3.27E+04	8.17E-01	7.99E-05	1.62E-24
Cu	176.00	63.6	993	1.00E-06	1.94E-08	5.10E+04	8.02E-01	7.85E-05	1.52E-12
Fe	0.00	55.9	315	1.38E-11	2.68E-13	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mn	38.80	54.9	1225	2.54E-29	4.91E-31	1.12E+04	2.05E-01	2.00E-05	9.83E-36
Ni	0.33	58.7	973	5.54E-37	1.07E-38	9.62E+01	1.64E-03	1.60E-07	1.72E-45
Al	11.60	27.0	183	8.28E-01	1.60E-02	3.36E+03	1.25E-01	1.22E-05	1.95E-07
Acetone	0.25	58.1	56.5	7.60E+02	1.47E+01	7.16E+01	1.23E-03	1.21E-07	1.77E-06
Bromobenzene	0.00	157.0	156.2	1.09E+02	2.12E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Chloromethane	0.02	50.5	-24,2	7.60E+02	1.47E+01	6.20E+00	1.23E-04	1.20E-08	1.77E-07
Ethylbenzene	0.02	106.2	136	2.26E+02	4.37E+00	4.84E+00	4.56E-05	4,46E-09	1.95E-08
m-, p-Xylene	0.03	106.2	139.3	2.57E+02	4.97E+00	9.39E+00	8.84E-05	8.65E-09	4.30E-08
o-Xylene	0.45	106.2	144.4	1.66E+02	3.21E+00	1.31E+02	1.24E-03	1.21E-07	3.88E-07

Date: October 2013 Revision No. 0

Table 2. Summary of Partial Pressure Calculation (Continued)

	<u> </u>	<u> </u>		<u> </u>			1	1	
Compounds Potentially Present in Intermediate Tank Headspace	Conc. in Neutralent (mg/L)	Mol. Wt	bp °C	VP at 95°C (mmHg)	VP at 95°C (psia)	Mass in Neutralent (mg)	Mass in Neutralent (gm moles)	Mole Fractions in Neutralent	Partial Pressure (psia)
Styrene	0.04	104.1	145.2	1.61E+02	3.11E+00	1,28E+01	1.23E-04	1.21E-08	3.75E-08
Methyl ethyl ketone	1.83	72.1	79.64	7.60E+02	1.47E+01	5.30E+02	7.35E-03	7.19E-07	1.06E-05
Naphthalene	0.10	128.2	218	1.49E+01	2.88E-01	3.01E+01	2.35E-04	2.30E-08	6.63E-09
Toluene	0.12	92.1	110.6	4.76E+02	9.20E+00	3.36E+01	3.65E-04	3.57E-08	3.28E-07
Benzoic acid	0.00	122.1	249.2	9.63E-01	1.86E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+0
Phenol	0.00	94.1	182	3.27E+01	6.32E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2,4,5-Trichlorophenol	0.20	197.5	248	3.67E+00	7.10E-02	5.79E+01	2.93E-04	2.87E-08	2.04E-09
2.4,6-Trichlorophenol	0.20	197.5	246	2.04E+00	3.94E-02	5.79E+01	2.93E-04	2.87E-08	1.13E-09
2,4-Dinitrotoluene	0.19	182.1	300	7.08E-01	1.37E-02	5.59E+01	3.07E-04	3.00E-08	4.11E-10
2-Methylphenol	0.20	108.1	191	2.47E+01	4.78E-01	5.79E+01	5.36E-04	5.24E-08	2.50E-08
3&4-Methylphenol	0.20	108.1	202	1.57E+01	3.04E-01	5.79E+01	5.36E-04	5.24E-08	1.59E-08
Hexachlorobenzene	0.20	284.8	323	1.96E-02	3.79E-04	5.79E+01	2.03E-04	1.99E-08	7.54E-12
Hexachlorobutadiene	0.20	260.8	210	1.39E+01	2.69E-01	5.79E+01	2.22E-04	2.17E-08	5.84E-09
Hexachloroethane	0.20	236.7	186.7	2.74E+01	5.30E-01	5.79E+01	2.45E-04	2.39E-08	1.27E-08
Nitrobenzene	0.10	123.1	210	1.71E+01	3.31E-01	2.84E+01	2.31E-04	2.26E-08	7.46E-09
Pentachlorophenol	0.20	266.3	310	7.57E-02	1.46E-03	5.79E+01	2.18E-04	2.13E-08	3.12E-11
Pyridine	0.20	79.1	115.3	4.38E+03	8.47E+01	5.79E+01	7.33E-04	7.17E-08	6.07E-06
1,1-Dichloroethene	0.27	96.9	32	7.60E+02	1.47E+01	7.91E+01	8.16E-04	7.98E-08	1.17E-06
1,2-Dichloroethane	0.10	99.0	83.5	7.60E+02	1.47E+01	2.90E+01	2.93E-04	2.86E-08	4.21E-07
1,4-Dichlorobenzene	0.26	147.0	174.12	6.94E+01	1.34E+00	7.39E+01	5.03E-04	4.92E-08	6.60E-08
Benzene	4.08	78.1	80.1	7.60E+02	1.47E+01	1.18E+03	1.51E-02	1.48E-06	2.18E-05
Carbon tetrachtoride	0.00	153.8	77	7.60E+02	1.47E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Chlorobenzene	0.22	112.6	131	2.51E+02	4.85E+00	6.46E+01	5.74E-04	5.62E-08	2.73E-07
Chloroform	0.70	119.4	61.2	7.60E+02	1.47E+01	2.04E+02	1.71E-03	1.67E-07	2.45E-06
Tetrachloroethene	4.88	165.8	121.1	3.49E+02	6.75E+00	1.41E+03	8.53E-03	8.34E-07	5.63E-06

Table 2. Summary of Partial Pressure Calculation (Continued)

								Mole	
Compounds Potentially Present in Intermediate Tank Headspace	Conc. in Neutralent (mg/L)	Mol. Wt	bp °C	VP at 95°C (mmHg)	VP at 95°C (psia)	Mass in Neutralent (mg)	Mass in Neutralent (gm moles)	Fractions in Neutralent	Partial Pressure (psia)
Trichloroethene	8.89	131.4	86.9	7.60E+02	1.47E+01	2.58E+03	1.96E-02	1.92E-06	2.82E-05
Vinyt chloride	19.03	62.5	-13	7.60E+02	1.47E+01	5.51E+03	8.82E-02	8.63E-06	1.27E-04
Methylene chloride	0.00	84.9	39.8	7.60E+02	1.47E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1,2,4-Trimethylbenzene	0.03	120.2	169	6.94E+01	1.34E+00	8.20E+00	6.82E-05	6.67E-09	8.96E-09
1,1,2-Trichloroethane	0.04	133.4	113.8	4.27E+02	8.26E+00	1.13E+01	8.47E-05	8.29E-09	6.84E-08
n-Propylbenzene	0.02	120.2	159	9.68E+01	1.87E+00	4.90E+00	4.07E-05	3.99E-09	7.46E-09
p-Isopropyltoluene	0.04	134.2	177.1	5.66E+01	1.09E+00	1.19E+01	8.85E-05	8.66E-09	9.48E-09
1,3,5-Trimethylbenzene	0.05	120.2	165	7.71E+01	1.49E+00	1.49E+01	1.24E-04	1.21E-08	1.81E-08
1,4-Dithiane	25.48	120.2	199	2.71E+01	5.24E-01	7.38E+03	6.14E-02	6.01E-06	3.15E-06
1,4-Thioxane	8.96	104.2	147	1.38E+02	2.67E+00	2.60E+03	2.49E-02	2.44E-06	6.51E-06
Mustard (HD)	0.07	159.1	217	8.12E+00	1.57E-01	2.14E+01	1.35E-04	1.32E-08	2.07E-09
Water	4.86E+05	18.0	100	6.22E+02	1.20E+01	1.41E+08	7.813E+03	7.64E-01	9.19E+00
MEA	4.76E+05	61.1	170	3.33E+01	6.44E-01	1.38E+08	2.260E+03	2.21E-01	1.42E-01
Unidentified Components from Agent Reaction with Reagent	6.07E+04	120.2	unknown	9.68E+01	1.87E+00	1.76E+07	1.46E+02	1.43E-02	2.68E-02
Inert Purge Gas:									
Helium		4	-269			0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nitrogen		28	-195.8			0.00E+00	0.00E+00	0.00E+00	0.00E+00
Inert gas (Initially Present in System)		28.0	-195.8			0.00E+00	0.00E+00	0.00E+00	5.36E+00

Date: October 2013 Revision No. 0

EDS-ITVP CALC - 1

Table 2. Summary of Partial Pressure Calculation (Continued)

Compounds Potentially Present in	Conc. in Neutralent	Mol.		VP at 95°C	VP at 95°C	Mass in Neutralent	Mass in Neutralent	Mole Fractions in	Partial Pressure
Intermediate Tank Headspace	(mg/L)	Wt	bp °C	(mmHg)	(psia)	(mg)	(gm moles)	Neutralent	(psia)
Total	1.02E+06	NA	NA	1.30		2.97E+08	1.02E+04	1.00E+00	1.25E+01
Total Organics	5.37E+05	NA	NA			1.56E+08	2.41E+03	2.35E-01	1.69E-01

Notes:

Most vapor pressures were determined using a suitable Antoine equation. Sources of the Antoine equations are listed in Section 6.0 References. If a suitable Antoine equation could not be found the vapor pressure was determined from empirical data with interpolation to 95°C using the relationship log of vapor pressure versus 1/temperature in degrees K. For compounds with a boiling point at or below 95°C vapor pressure of 760 mmHg was used.

For this calculation it was assumed all of the unknown compounds were organics. The molecular weight and vapor pressure used are the median values for all other organics minus the reagent, MEA.

bp boiling point c.ft. = cubic foot gm mol = gram mole kPa = kilopascals

MEA = monoethanolamine mq/L =milligram per liter

milligram mg

mmHg = millimeter of mercury mol.wt = molecular weight not applicable

pound per square inch actual psia =

VР vapor pressure